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ELECTRIC LOCOMOTIVE PROGRESS

By R. Thomas Sawyer, '23

RIDING the rails at 105 miles an hour is even more thrilling than watching a streak of green as the Paris-Orleans electric locomotive flashes by. Even then she was not clear open, for the length of test track at the Erie Works of the General Electric Company did not permit it. This remarkable locomotive is now on its way to France—a country which now can claim the fastest locomotive in the world, yet with a name plate which signifies, "made in U. S. A." This high speed was recently obtained at an exhibition test for prominent officials of many of our steam railroads and manufacturing plants. There were also several professors present from middle western universities. In fact, altogether there were several hundred watching the tests, each very much interested to note the great progress which had taken place in electric locomotive ability.

In these same shops there are being completed ten fast freight locomotives for Mexico. One of these has possibly the strongest drawbar pull of any electric locomotive. A large demonstration was performed by a tug of war to prove the great strength of this type of locomotive. A Mikado, one of the largest steam engines of the New York Central Railroad, steamed onto the test track and coupled up with one of these ten Mexican locomotives. It was a grand sight to see those two engines pulling each other. The steam freight locomotive was like a great monster breathing deeply, snorting and enclosed within a cloud of steam. The Mexicano stood there silently withont a word to say. When Mr. W. B. Potter, from Schenectady, dropped the flag, they both pulled and the electric motors turned toward their goal with the steam struggling in vain. Even when this great steam engine had obtained momentum, moving five miles an hour, the electric locomotive stopped it and pulled in the other direction.

The progress of electric transportation is rapidly advancing. These tests prove again the superiority of that silent power, electricity. This is another step towards the electrification of steam railroads, yet electrification is only in its infancy. As an infant it has struggled many years to surpass the stea mengine. The longest electrified main line of a steam railroad today is the Chicago, Milwaukee & St. Paul. Undoubtedly within the next few years many steam lines in this country will have started to electrify, section by section. The superiority of this clean silent power will compel them to do so.

The Paris-Orleans and the Mexicano locomotives are of two distinct types, yet to most observers they look alike. Why is it that one has such terrific speed suitable for fast passenger service and the other has such great power for hauling heavy freight trains? The following explanation will clearly bring this forth.

The ten 150-ton 3,000-volt D. C. Mexican freight locomotives, with no new principles involved, represent the latest practice in heavy main line locomotive construction. The running gear for each unit consists of three 2-axle trucks, each driven by two twin geared motors with all of the pulling stresses transmitted through articulated joints. Each of the six 1,500 volt motors has 450 horse power, driving the wheels at a gear ratio of five to one. These driving wheels have a diameter of 46 inches and produce a tractive effort of about 55,000 pounds.

The 3,000 volt supply direct current is taken from the overhead trolley through the usual type of sliding pantograph collector. The motor grouping is arranged to give three running speeds with full field connection and additional running speeds with reduced fields. On account of the heavy grades in the electric zone, regenerative electric braking is provided, which may be employed with any of the three principal running speeds.

In the year 1907 the first gearless commercial locomotive was built. Today the Paris-Orleans, with a possible speed of 125 miles an hour, represents the most modern of this type of locomotive. It was built as a sample locomotive which called for units having approximately 80 tons on drivers and designed for maximum free running speeds up to 130 kilometers (80.8 miles) per hour on a 1,500 volt D. C. line.

This locomotive, of the gearless type, has two 3-axle driving trucks in the center and a 2-axle guiding truck at each end. The motor fields and frames are constructed to form an integral part of the platform and running gear, and the armatures are mounted directly on the driving axles. The six 750 volt motors of over 400 horse power each are very different from the motors on the Mexicano locomotives as they have only two poles instead of each having four and also the armature shaft is the axle itself, therefore they use no gears. This is where the remarkable high speed is obtained with no gear reduction but an absolute direct drive. The driving wheels with a diameter of 47.2 inches, practically the same diameter as those on the Mexicano, produce a draw bar pull of 14,586 pounds. The weight on the two sets of drivers is 159,720 pounds with 238,480 pounds as a total weight. This locomotive is not equipped for regenerative electric braking, however, space is provided for the installation of equipment for this purpose and the motors will operate successfully during regeneration with trolley voltages as high as 1,800 volts. Current is collected through the usual sliding pantograph, two being provided.

A serious question was settled last summer, that was whether enough power could be taken from the overhead trolley to drive these mightly silent engines. It was found that it took 1,500 amperes at 3,000 volts to draw a 7,000-ton train at 40 miles on hour. 3,000 amperes at 1,500 volts would be required for the Paris-Orleans during acceleration. A 110-ton locomotive, with a freight car weighed down with resistances and a passenger car, easily settled this question. This train made numerous current collecting tests, using the standard practice of two pantographs for heavy duty loads, and at the rate of 60 miles an hour it took all of the current which the substation could provide, which was 5,400 amperes. This is much more than a heavy train needs today.

Another question has been settled by a new device called the otheograph. This records the vertical and horizontal thrusts of each wheel of a locomotive or train on the track. It was especially interesting in noting the difference between the vibrations of a steam and electric locomotive, particularly the smoothness of the high speeds of the Paris-Orleans. The otheograph consists two feet apart which support the rails on vertical and horizontal springs. Each tie holds two recorders at each rail which are similar to engine indicators. This of a number of steel ties, twenty-five in this case, placed device has proven to be very satisfactory and has been praised by many engineers.

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The ten Mexicanos will soon leave to ply on the road from Vera Cruz to the heights of Mexico City. These powerful locomotives will operate along a section which has a rise of 4 feet in every 100 for practically 30 miles. The stream line high speed locomotive is on its way across the seas to sunny France to pull the fast passenger trains from that beautiful city Paris to "Old" Orleans.

Driving 120 tons along at 105 miles an hour or pulling a heavy Mikado steam engine against its will with silent power are indeed two marvelous feats. So when the many engineers went home after viewing these remarkable tests they must have had only one thought: the great progress achieved in electric locomotive ability.